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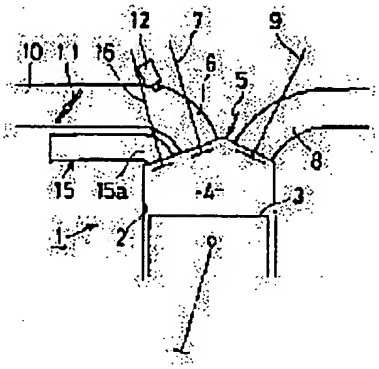
(54) **ENGINE**



(57)Abstract:
PURPOSE: To provide an engine capable of scavenging residual gas even if it is an engine of natural air intake type, with a turbo charger supercharger or with a mechanical supercharger.
CONSTITUTION: An engine 1 opens a storage chamber port 15a as well as an air intake port 6 and an exhaust port 8 to a combustion chamber 4 and is communicated through to a storage chamber 15, and a storage chamber valve 16 is arranged on the storage chamber port 15a. The storage chamber valve 16, for example, works to open and close twice every one cycle, and at the first opening and closing motion, it opens at the end of exhaust process and closes at the initial stage of air intake process. The second opening and closing motion is set in compression process after an air intake valve 7 is closed and takes part of high pressure air in the combustion chamber 4 into the storage chamber 15. The high pressure air stored in the storage chamber 15 is

cooled in the storage chamber 15. The cooled high pressure air is delivered into the combustion chamber 4 by the first opening and closing motion of the storage chamber valve 16, and residual gas in the combustion chamber 4 is pushed out to the exhaust port 8.

CLAIMS

[Claim(s)]

[Claim 1] It is the engine which is formed in an engine, is equipped with the reservoir room which carries out opening to a combustion chamber, and the reservoir room bulb which open and close opening of this reservoir room, and is characterized by what said reservoir room bulb is opened at the telophase of like an exhaust air line, and is done for clausilium by the compression stroke.

[Claim 2] Said reservoir room bulb is an engine characterized by what is opened before an inlet valve is opened in claim 1.

[Claim 3] It is the engine characterized by what is set up when said both reservoir room bulbs are opened in claim 1 at the BARUBUO-BARAPPU period when an exhaust valve and an inlet valve will be in a valve-opening condition and the valve-opening timing of this reservoir room bulb has the amount of lifts of an exhaust valve larger than the amount of lifts of an inlet valve.

[Claim 4] It is the engine characterized by what said reservoir room bulb is opened in claim 1 at the telophase of like an exhaust air line, this valve-opening condition is continued after that, and is done for clausilium in the middle of a compression stroke.

[Claim 5] It is the engine characterized by what the 1st switching action by which said reservoir room bulb is opened and closed in claim 1 at the telophase of like an exhaust air line, and the 2nd switching action by which clausilium is carried out into a compression stroke after opening the second half like an inhalation-of-air line are made to be performed.

[Claim 6] It is the engine characterized by what the 1st switching action by which said reservoir room bulb is opened and closed in claim 1 at the telophase of like an exhaust air line, and the 2nd switching action which are opened and closed in the compression stroke after an inlet valve closes are made to be performed.

[Claim 7] It is the engine characterized by what said reservoir room bulb is opened in claim 1 at the telophase of like an exhaust air line, and the 2nd switching action by which clausilium is carried out into a compression stroke after opening the second half like the 1st switching action by which clausilium is carried out in early stages and inhalation-of-air line like an inhalation-of-air line is made to be performed.

[Claim 8] It is the engine characterized by what said reservoir room bulb is opened in claim 1 at the telophase of like an exhaust air line, and the 2nd switching action opened and closed in the compression stroke after the 1st switching action by which clausilium is carried out in early stages and inlet valve like an inhalation-of-air line close is made to be performed.

[Claim 9] The engine characterized by having the EGR control bulb infixed in the EGR path which flows back in an inhalation-of-air system in a part of engine exhaust gas, and this EGR path in any one claim of claim 5 thru/or claim 8, and the EGR timing control means which makes this EGR control bulb open the second half like an inhalation-of-air line.

[Claim 10] The engine characterized by what said engine is used as the natural aspiration-type

engine for in any one claim of claim 1 thru/or claim 9.
[Claim 11] The engine characterized by what is considered as the supercharged engine which said engine equipped with the turbocharger driven by the energy of exhaust gas in any one claim of claim 1 thru/or claim 9.
[Claim 12] The engine characterized by what is considered as the supercharged engine which said engine equipped with the mechanical supercharger driven by engine power in any one claim of claim 1 thru/or claim 9.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to what put into practice scavenging of the residual gas which remains in a combustion chamber in more detail about an engine.
[0002]
[Description of the Prior Art] As a means which raises engine thermal efficiency, although high compression ratio-ization of a compression ratio is known, when an engine compression ratio is raised, there is a problem of becoming easy to generate knocking.
[0003] Scavenging the residual gas which enlarges the so-called BARUBUO-BARAPPU period when an inlet valve and an exhaust valve are made into an aperture condition, and remains in a combustion chamber is indicated by both JP,2-119621,A to the problem of this knocking. That is, whenever [cylinder internal temperature] is lowered by scavenging hot residual gas, and it enables this to suppress generating of knocking.
[0004]
[Problem(s) to be Solved by the Invention] However, although scavenging by expansion of a BARUBUO-BARAPPU period has an effective intake pressure to a larger engine with a mechanical supercharger than exhaust gas pressure, its exhaust gas pressure is more powerless than an intake pressure to a large natural aspiration type engine or an engine with a turbocharger.
[0005] Then, the purpose of this invention is to offer the engine which enabled it to perform scavenging with respect to an engine form that there is nothing.
[0006]
[Means for Achieving the Goal] That the above-mentioned technical technical problem should be attained, if it is in this invention, it is formed in an engine, it has the reservoir room which carries out opening to a combustion chamber, and the reservoir room bulb which open and close opening of this reservoir room, and it opens at the telophase of like an exhaust air line, and said reservoir room bulb is considered as the configuration by which clausilium is carried out by the compression stroke.
[0007]
[Function] According to the above-mentioned configuration, in a compression stroke, high-pressure air is incorporated at a reservoir room, and the high-pressure air stored in this reservoir room is breathed out by the combustion chamber after that at the telophase of like an exhaust air line. And like this exhaust air line, since a combustion chamber is in an elevated-temperature condition, while the elevated-temperature air of the reservoir interior of a room is accompanied by expansion, it will spout to a combustion chamber, and hot residual gas will be extruded by jet of this high-pressure air at an exhaust air port side. That is, scavenging will be performed by the

high-pressure air of the reservoir interior of a room.
[0008] In addition, there is an engine of an indication in JP,54-116512,A, JP,54-980408,A, etc. as a conventional technique approximated to this invention on structure. This engine equips the combustion chamber with the reservoir room which carries out opening, and the reservoir room bulb which open and close opening of this reservoir room, and is as common to this point as this invention.
[0009] However, this engine with a reservoir room opens a reservoir room bulb according to the closing stage of an inlet valve, and differs from this invention at the point which has generated the swirl strong against a combustion chamber using the air of the reservoir interior of a room (using the differential pressure of a reservoir room and a combustion chamber).
[0010]
[Example] Below, it explains based on the drawing which appended the example of this invention. In drawing 1 , a sign 1 is an engine and a combustion chamber 4 is formed by the piston 3 by which the engine 1 was fitted in into the cylinder bore 2. This combustion chamber 4 is a pen torr. - It considers as a FU mold, and an ignition plug 5 is arranged by that crowning, and an inlet valve 7 is arranged in the suction port 6 which faces a combustion chamber 4 and carries out opening, and the exhaust valve 9 is arranged in the exhaust air port 8. And a throttle valve 11 is arranged, and the inhalation-of-air path 10 which stands in a row in the above-mentioned suction port 6 is made to attend a suction port 6, and the fuel injection valve 12 is arranged in it.
[0011] Moreover, the above-mentioned engine 1 has the reservoir room 15. Opening of that reservoir room port 15a is carried out to a combustion chamber 4, the reservoir room bulb 16 is arranged in reservoir room port 15a, and, as for the reservoir room 15, reservoir room port 15a is opened and closed by this reservoir room bulb 16.
[0012] An example of the closing motion stage of the above-mentioned reservoir room bulb 16 is shown in drawing 2 . In drawing 2 , a broken line shows the valve timing of an exhaust valve 9. Moreover, a dashed line shows the valve timing of an inlet valve 7. Moreover, a continuous line shows the valve timing of the reservoir room bulb 16.
[0013] As for the reservoir room bulb 16, two switching actions per 1 cycle are performed so that clearly from drawing 2 . That is, before an inlet valve 7 opens the 1st switching action, the reservoir room bulb 16 is opened, and closing timing of the reservoir room bulb 16 is carried out after an inlet valve 7 opens.
[0014] If it puts in another way, the 1st switching action of the reservoir room bulb 16 will be opened at the telophase of like an exhaust air line, and will be closed the first stage like an inhalation-of-air line. On the other hand, the reservoir room bulb 16 is opened the second half like an inhalation-of-air line (before an inlet valve 7 closes), and, as for the 2nd switching action of the reservoir room bulb 16, the reservoir room bulb 16 is closed in a compression stroke. In addition, you may make it open the reservoir room bulb 16 in this 2nd switching action before an inhalation-of-air bottom dead point.
[0015] In the switching action of the 1st above-mentioned reservoir room bulb 16, the reservoir room bulb 16 is closed the first stage like an inhalation-of-air line because it is meaningless in having driven in residual gas to the suction-port 6 side. In addition, you may make it close the reservoir room bulb 16 as closing timing of the reservoir room bulb 16 according to the valve-opening timing of an inlet valve 7.
[0016] In the above-mentioned configuration, that part will be confined in the reservoir room 15 by the 2nd switching action of the reservoir room bulb 16 performed by the compression stroke from the second half like an inhalation-of-air line, and the high-pressure air in a combustion

chamber 4 will be cooled in this reservoir room 15.
[0017] And the high-pressure air cooled at this reservoir room 15 is breathed out by the 1st switching action of the reservoir room bulb 16 in a combustion chamber 4. That is, the high-pressure air in the reservoir room 15 will blow off expanding in the combustion chamber 4 in an elevated-temperature condition, and will extrude the residual gas of a combustion chamber 4 to the exhaust air port 8 (scavenging air of residual gas).
[0018] Drawing 3 shows the modification of the switching action of the reservoir room bulb 16. Although the reservoir room bulb 16 is opened at the telophase of like an exhaust air line like the case of drawing 2 and it is closed by the compression stroke so that clearly from drawing 3 , in this modification, the valve-opening condition of the reservoir room bulb 16 is continued in the meantime. According to this modification, since the aperture condition of the reservoir room bulb 16 is continued for a long time, there is an advantage of being easy to set up the big amount of lifts. When the inlet valve 7 and the reservoir room bulb 16 were open to coincidence and residual gas would be driven in here at the suction-port 6 side, it mentioned above, but by choosing aperture timing of the reservoir room bulb 16 suitably (setup), before an inlet valve 7 opens, it is possible to make scavenging air (for residual gas to be extruded to the exhaust air port 8) complete.
[0019] As other modifications in the switching action of the reservoir room bulb 16, although illustration was omitted, when making the switching action of the reservoir room bulb 16 perform twice, it may be made to perform the 2nd switching action (incorporation of high-pressure air) into the compression stroke after the inlet valve 7 was closed. That is, it may be made to perform the 2nd switching action of the reservoir room bulb 16 into the compression stroke after the inlet valve 7 was closed.
[0020] As an operating space of the reservoir room bulb 16, the reservoir room bulb 16 is operated to a heavy load field, and it may be made to stop actuation of the reservoir room bulb 16 in a light load field (a closing condition is maintained). According to this, using the reservoir room 15, since scavenging of residual gas is possible, in a heavy load field, there is an advantage that knocking generating at the time of heavy load operation can be suppressed by the fall of whenever [accompanying this scavenging / cylinder internal temperature].
[0021] Therefore, high compression ratio-ization is attained if it is in a natural aspiration type engine. Moreover, if it is in the engine with a turbocharger driven with exhaust air energy, a raise in a compression ratio and/or high charge pressure-ization are attained. Moreover, if it is in an engine with a mechanical supercharger, it is not necessary to expand a BARUBUO-BARAPPU period and there is an advantage that scavenging can be planned.
[0022] On the other hand, in a light load field, since the reservoir room 15 closes and it considers as a condition, there is an advantage that the compression loss accompanying opening and closing the reservoir room bulb 16 in a compression stroke can be prevented. Since a compression stroke will be performed under the volume of the volume plus reservoir room 15 of a combustion chamber 4 when a compression stroke is made to open and close the reservoir room bulb 16 if it puts in another way, compression loss arises.
[0023] Of course, in a heavy load field and a light load field, it may be made to perform scavenging using the above-mentioned reservoir room 15. That is, although it is usually to change sharply the amount of the residual gas which remains in a combustion chamber 4 for every cycle, since fluctuation of the amount of residual gas can be suppressed by scavenging using the above-mentioned reservoir room 15, the combustion stability in this light load field is securable. Therefore, if it is in the so-called lean burn engine which carries out engine control

under the Lean air-fuel ratio, there is an advantage that the Lean degree of an air-fuel ratio can be enlarged (expansion of the Lean limitation of an air-fuel ratio). Or there is an advantage that idle operation can be made stable.

[0024] Drawing 4 - drawing 6 show an example of the actuation halt device 19 of the reservoir room bulb 16. The engine shown in drawing 4 equips one gas column with two inlet valves 7 and 7 and two exhaust valves 9 and 9, and let these inlet valves 7 and an exhaust valve 9 be the engines (DOHC mold engine) of the DABURUO-BAHEDDOKAMU type driven by the cam shafts 20 and 21 which achieved individual independence. That is, it is carried out to inlet valves, and the cam shaft 20 of 1 is used as exhaust valves, and like known, other cam shafts 21 are coordinated with an engine output shaft, and it rotates these cam shafts 20 and 21 synchronizing with an engine output shaft.

[0025] The cam 22 for reservoir room bulb 16 is arranged by the cam shaft 20 for inlet valves, and between the cam 22 for reservoir room bulbs, and the reservoir room bulb 16, the 1st rocker 23 which contacts the reservoir room bulb 16, the 2nd rocker 24 which contacts a cam 22, and ** are located in a line, and it is arranged here. These 1st and 2nd rockers 23 and 24 are made rockable at the circumference of a hollow shaft 25, and the 2nd rocker 24 is energized in the direction which contacts a cam 22 with a spring 26 (refer to drawing 5).

[0026] As shown in drawing 5 and drawing 6 , 1st hole 23a and 2nd hole 24a which counter mutually and carry out opening are respectively formed in the 1st and 2nd rocker 23 and 24 of the above. The connection pin 27 is fitted in these 1st and 2nd holes 23a and 24a possible [sliding]. When it is energized by the compression spring 28 at the 2nd rocker 24 side and oil pressure is supplied to pressure room 24b, this connection pin 27 The connection pin 27 invades into the 1st rocker 23, the 1st and 2nd rocker 23 and 24 is unified by this connection pin 27 (refer to drawing 6), and the closing motion drive of the reservoir room bulb 16 is carried out by the cam 22.

[0027] On the other hand, when the drain of the oil pressure of pressure room 24b is carried out, as shown in drawing 5 , the connection pin 27 is put back to 2nd rocker side the 24 side by the spring force of a compression spring 28, association with the 1st and 2nd rocker 23 and 24 by the connection pin 27 is canceled, and, thereby, actuation of the reservoir room bulb 16 is suspended. In addition, when spring energization is carried out in the direction of clausilium, therefore actuation of the reservoir room bulb 16 is suspended, as for the reservoir room bulb 16, a closing condition is maintained so that the reservoir room bulb 16 may be mentioned later. Moreover, the supply or release of oil pressure to the above-mentioned pressure room 24b is performed using oil path 25a within a hollow shaft 25 (refer to drawing 5 and drawing 6).

[0028] Drawing 7 - drawing 10 show the example of said reservoir room 15, drawing 7 and drawing 8 show an example, among these drawing 9 R> 9 and drawing 10 show other examples. In addition, the reference mark same about the same thing as the element mentioned above among each element indicated by these drawings is attached, the explanation is omitted, and explanation is added to below only about the description part of each example.

[0029] In drawing 7 and drawing 8 , a sign 30 is the cylinder head and the suction-port 7 grade is formed in the cylinder head 30 like known. Moreover, by this example, the cylinder head 30 is used as the 4-cylinder engines which arranged four bulbs on each gas column, and opening of the reservoir room port 15a is carried out to the field (and GASUZO-N [Inspired air flow path]) across which it faced by two suction ports 6 and 6 to the combustion chamber 4. And reservoir room port 15a is prolonged along with the above-mentioned suction port 6, and opening is carried out to one side face (side face as for which a suction port 6 carries out opening) of the

cylinder head 30.
[0030] On the other hand, when the hollow 15 which carries out opening towards a cylinder head 30 side is established in the down-stream edge and an inlet manifold 31 is attached to the cylinder head 30 by the inlet manifold 31 (member which forms the independent inhalation-of-air path which is open for free passage to the suction port 7 of each gas column) combined with one side face of the cylinder head 30, in it, a hollow 15 constitutes the reservoir room 15.
[0031] According to the example concerned, in the phase which high-pressure air stored in the reservoir room 15, air cooling of the high-pressure air will be carried out, and it will be carried out [water cooling] in the phase which flows reservoir room port 15a by the engine cooling water passing through the cooling water path 32 of the circumference of this port 15a. In addition, the direct drive of the reservoir room bulb 16 is carried out by said cam 22 here. A sign 33 is a return spring.
[0032] Moreover, in the case of the main ignition type engine which arranged the ignition plug 5 on the core of a combustion chamber 4, it is thought that a knocking generating point is end GASUZO-N of an inspired air flow path. Therefore, if it is in the example concerned, since opening of the reservoir room port 15a has been carried out to end GASUZO-N of this inspired air flow path, knocking control accompanying scavenging can be made effective.
[0033] The cylinder head 30 shown in drawing 9 and drawing 10 is used as the DOHC mold 4-cylinder engines of 3 bulb types which arranged two inlet valves 7 and 7 and one exhaust valve 9 on each gas column. And opening of the reservoir room port 15a is carried out to the improvement style side in a way to which the swirl S generated by the combustion chamber 4 flows to two suction ports 6 and 6, and the flow direction of Swirl S points to this reservoir room port 15a. It can avoid flowing into the direct exhaust air port 8, without promoting the outflow of the air in the reservoir room 15 by Swirl S by this, and the high-pressure air in the reservoir room 15 contributing to scavenging.
[0034] Moreover, as for the engine 1, let the firing order at order be No. 1 cylinder-No. 3 cylinder-No. 4-cylinder-No. 2 cylinder with reference to drawing 9 .
[0035] On the other hand, the reservoir room 15 is constituted in the interior of the cylinder head 30 by two drilled holes 40 and 41 prolonged in a longitudinal direction, and the 1st drilled hole 40 is made into the common reservoir room 15 for No. 1 cylinder and No. 3 cylinders, and let the 2nd drilled hole 41 be the common reservoir room 15 for No. 3 cylinder and No. 4-cylinders.
[0036] Drawing 11 and drawing 12 show other examples of this invention. If it is in this example, as shown in drawing 11 , the EGR path 40 which flows back in an inhalation-of-air system is connected to about six downstream of the inhalation-of-air path 10, i.e., a suction port, in a part of exhaust gas. the EGR control valve 41 infixes in the EGR path 40 -- having -- this EGR control valve 41 -- the electromagnetism as an actuator -- the solenoid 42 is connected.
[0037] In drawing 11 , a sign 45 is a control unit, and a control unit 45 consists of microcomputers and it possesses CPU, ROM, RAM, etc. like known. The signal from sensors 50-52 is inputted into a control unit 45.
[0038] The above-mentioned sensor 50 detects an engine speed. The above-mentioned sensor 51 detects an engine load (opening of a throttle valve 11). The above-mentioned sensor 52 detects a crank angle.
[0039] If the contents of 2 control performed by the above-mentioned control unit 45 are explained, in a light load field, the EGR control valve 41 will close in a line crack and a heavy load field, it will consider as a condition, and, as for the exterior EGR which used the above-mentioned EGR path 40 first, Exterior EGR will be forbidden.

[0040] As it is shown in drawing 12 on the assumption that the above thing, said EGR control valve 41 is opened the second half like an inhalation-of-air line, and the amount of EGR(s) which suits an engine operation condition flows back in an inhalation-of-air system.
[0041] Moreover, when acceleration is started in response to detection (rapid aperture actuation of a throttle valve 11) of acceleration before the EGR control valve 41 was opened, valve opening of the EGR control valve 41 is forbidden. On the other hand, when the EGR control valve 41 is opened and acceleration is started, clausilium of the EGR control valve 41 is carried out immediately.
[0042] The above configuration enables it to reduce a pumping loss by the exterior EGR which used the EGR path 40 in light load operational status first. Moreover, also in this light load operating range, since scavenging is performed for every cycle using the reservoir room 15, it becomes possible to suppress large fluctuation of the internal EGR (residual gas) accompanying change of inhalation-of-air negative pressure. Therefore, operational status in a light load field can be made stable by EGR (control of the amount of EGR gas) controlled by the EGR control valve 41.
[0043] Moreover, since the EGR control valve 41 is suitably closed according to initiation of acceleration, the gap with real ignition timing and demand ignition timing can be made into a small thing. When this point is explained in detail, there are many amounts of the burnt gas which flows backwards in an inhalation-of-air system in the state of light load steady operation first for inhalation-of-air negative pressure. On the other hand, since the tubing internal pressure of an inhalation-of-air system is atmospheric pressure in the state of full load steady operation, there are few amounts of the burnt gas which flows backwards in an inhalation-of-air system. Therefore, also quantitatively in the time of light load operation, the residual gas in a combustion chamber 4 is comparatively large also on a target, and, also quantitatively, residual gas is comparatively small also on a target in the time of another side full load running. Ignition timing is set up on the basis of the rate of the residual gas in such a steady operation condition.
[0044] However, since a combustion chamber 4 will be filled up with a lot of new mind with the burnt gas which flowed backwards in the inhalation-of-air system when acceleration is performed to inside, it becomes a different residual gas rate also from a light load steady operation condition and a full load steady operation condition, this becomes a cause, and a gap generates an inhalation-of-air line between real ignition timing and demand ignition timing.
[0045] Residual capacity is mostly determined that it will consider the above point by the initial stage like an inhalation-of-air line. Therefore, it scavenges for every cycle using the high-pressure air in the reservoir room 15, and it becomes possible by controlling the amount of EGR gas the second half like an inhalation-of-air line further to correspond also to sudden acceleration also as opposed to a steady operation condition.
[0046] Drawing 13 and drawing 14 show other examples of this invention. If it is in this example, it considers as 4 bulb engine equipped with two suction ports 6 and two exhaust air ports 8 to one gas column, and suction-port 6A of one is made into a swirl port between two suction ports 6, and let other suction-port 6B be straight ports.
[0047] And the shutter valve (S valve) 43 is arranged in independent inhalation-of-air path 10B which swirl port 6A and straight port 6B were opened for free passage by the independent inhalation-of-air paths 10A and 10B which achieved individual independence, and was opened for free passage by straight port 6B, and the closing motion drive of the shutter valve 43 is carried out by the electromagnetic actuator 44.
[0048] The above-mentioned shutter valve 43 is controlled based on the control map shown in

drawing 14 . That is, across Rhine L1, by the high rotation side, the shutter valve 43 is opened and inhalation of air is performed using two suction ports 6A and 6B. On the other hand, across Rhine L1, by the low rotation side, the shutter valve 43 is closed and inhalation of air is performed using swirl port 6A.

[0049] In the field to which the shutter valve 43 is closed on the assumption that the above thing, as shown in drawing 14 , the exterior EGR which used the EGR path 40 in the low rotation low load field II except the idle field I is performed.

[0050] If the timing of this exterior EGR is explained, before an inlet valve 7 is opened, as for the EGR control valve 41, that switching action will be performed. That is, supply of EGR gas is performed to the lower limit of the shutter valve 43 on the preceding paragraph story by which an inlet valve 7 is opened.

[0051] Before an inlet valve 7 opens in Field II by the above configuration, inhalation-of-air path 10B by the side of straight port 6B (lower stream of a river of the shutter valve 43) is filled up with EGR gas, and the tubing internal pressure of shutter valve 43 lower stream of a river rises with this EGR gas.

[0052] Therefore, with valve-opening actuation of an inlet valve 7, a combustion chamber 4 is first filled up with EGR gas from straight port 6B, and while new mind next generates Swirl S from swirl port 6A, it will fill up in a combustion chamber 4. Thereby, in a combustion chamber 4, EGR gas will exist in a lower layer, new mind will exist in the upper layer, the lamination in a combustion chamber 4 is attained, and the inflammable aggravation accompanying an EGR gas injection can be improved.

[0053] The improvement or NOx of fuel consumption by expansion of an EGR field Reduction can be aimed at. [if it puts in another way, since EGR can be performed securing combustion stability, the amount of EGR gas is increased and much more pumping loss can be reduced, and also]

[0054] As mentioned above, although the example of this invention was explained, you may make it apply this invention to the engine with a turbocharger which supercharges using exhaust air energy. Moreover, you may apply to the supercharged engine equipped with the mechanical supercharger driven mechanically by engine power.

[0055]

[Effect of the Invention] Even if it is which engine of the supercharged engine equipped with the natural aspiration type engine, the engine with a turbocharger, or the mechanical supercharger, according to this invention, it can scavenge, so that clearly from the above explanation.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The explanatory view showing the mechanical configuration of this invention notionally.

[Drawing 2] Drawing showing an example of the valve timing of the reservoir room bulb concerning this invention.

[Drawing 3] Drawing showing other examples of the valve timing of the reservoir room bulb

concerning this invention.
[Drawing 4] The top view showing the actuation halt device of a reservoir room bulb.
[Drawing 5] The sectional view showing the actuation idle state of a reservoir room bulb.
[Drawing 6] The sectional view showing the condition that the reservoir room bulb had actuation permitted.
[Drawing 7] Drawing showing the example of the reservoir room formed in the cylinder head, and a reservoir room port.
[Drawing 8] The sectional view which met the VIII-VIII line shown in drawing 7 .
[Drawing 9] Drawing showing other examples of the reservoir room formed in the cylinder head, and a reservoir room port.
[Drawing 10] The sectional view which met X10-X10 line shown in drawing 9 .
[Drawing 11] The sectional view showing other examples of this invention.
[Drawing 12] Drawing showing the timing of EGR using the valve timing and the external EGR path of a reservoir room bulb.
[Drawing 13] The whole engine block diagram showing the modification about Exterior EGR.
[Drawing 14] The control map used for control of the EGR control valve infixed in the shutter valve and external EGR path which were arranged in the inhalation-of-air system.
[Description of Notations]
1 Engine
3 Piston
4 Combustion Chamber
6 Suction Port
7 Inlet Valve
8 Exhaust Air Port
9 Exhaust Valve
10 Inhalation-of-Air Path
15 Reservoir Room
15a Reservoir room port
16 Reservoir Room Bulb
40 EGR Path
41 EGR Control Valve
43 Shutter Valve
45 Control Unit

[Translation done.]